

focus on

# Seaweed

**SEAWEED IS AN ABUNDANT SOURCE OF VALUABLE NUTRIENTS, AND HAS THE POTENTIAL TO BE USED IN ANTI-CANCER TREATMENTS, OR TO BOOST THE IMMUNE SYSTEM, WRITES ALEX KIRCHIN.**

**W**ith the ever increasing range of technologically advanced nutritional products available, it is easy to overlook the importance and contributions that certain health foods have made. Seaweed is a prime example of a much undermined and underused resource.

Analysis of sea water shows that it contains about 31 per cent sodium, while human blood contains about 34 per cent sodium. The concentrations of other elements, such as potassium, calcium, magnesium and chlorine are also much the same in sea water and blood. These similarities in nutrient composition provide us with some insight into the benefits of food from the deep.

There are three main types of algae, the generic Latin name for seaweed or kelp: *Chlorophyta* (green), *Phaeophyta* (brown) and *Rhodophyta* (red). These split up into families or orders ending in *-aceae* such as *Fucaceae*, *Laminariaceae*, and others. These families in turn split up into classes such as *Ascophyllum*, and species such as *Nodosum*. *Ascophyllum Nodosum*, a brown seaweed, is of the genera *Ascophyllum*, species *Nodosum* and type *Phaeophyta* of the order *Fucaceae*.

This discussion on the various benefits of seaweed for human consumption will focus on *Ascophyllum Nodosum*, the most studied species of the wild wracks, of the *Phaeophyceae* (brown algae) genus.

Seaweed is an abundant 'marine vegetable' which is particularly rich in minerals, trace elements and other nutrients





## History of use

The use of seaweed as food goes back thousands of years. In fact, Sze Teu wrote in 600 B.C. 'Seaweed is a delicacy fit for the most honourable guest, even for the King himself'. Although algae were known and prized for nutritional purposes at a very early date in the Orient, it took several centuries for the use of seaweed in the West to be mentioned. Around 45 BC the Greeks were known to have collected seaweed from the shore and fed it to their cattle to prolong their lives.

Due to industrialisation, city development and declining coastal populations, many of the traditional uses of seaweed in Europe have disappeared. Most of the world's *Ascophyllum* is harvested in the cold Arctic waters off the Norwegian coast. Nutritional uses of seaweed in Europe are still present, particularly the classic traditional recipes used in coastal areas of Wales, Ireland and other Northern European communities. Of European countries, France appears to be the most interested in the use of seaweed for human nutrition. In 1985 France produced 60,000t of seaweed and is now exporting through the health food and cosmetic industry.

Interest in seaweed has grown in recent years, because in the words of W.A Stephenson, an early pioneer of seaweed research, 'the nutrients leached out of the fields by rain, which are then lost to agriculture, sooner or later find their way to the sea where, in common with all the other salts and minerals there, they are universally and uniformly available. Seaweeds never suffer from shortage of nutrients and, living in a stable nutrient medium, are always of stable chemical composition.'

A global survey has shown that 107 genera and 493 species are being utilised by humans. *Ascophyllum* is utilised widely in animal nutrition and has been shown to improve fertility, milk yield and body weight in cows. Seaweed is a superb carrier for supplemental fodder compounds in animal husbandry.

## Chemical and nutritional composition

The polysaccharides found in sea vegetables are different from those in terrestrial vegetables. The brown algae are characterised by having beta-linked polymers of glucose and uronic acid. The enzymes

TABLE 1: NUTRITIONAL COMPOSITION OF *ASCOPHYLLUM NODOSUM* (PER 100G)

Protein	5-10g	Gold	traces
Carbohydrate	50-60g	Iodine	60,000mcg
of which		Iridium	traces
Algin	10-16g	Iron	15-100mg
Fucoidin	4-6g	Lithium	traces
Mannitol	2.5-4.8g	Magnesium	60-220mg
Methylpentosans	2.5-4.2g	Manganese	1000-5000mcg
Laminaran	1-3.6g	Molybdenum	30-100mcg
		Nitrogen	96-325mg
Fat	2-7g	Phosphorous	15-20mg
Fibre	4-7g	Platinum	traces
(non starch polysaccharides)		Potassium	240-750mg
Sodium	1.7-2.1g	Selenium	10-20mcg
Vitamin A (carotenoids)	9000-25000mcg	Silicon	50-150mg
		Silver	traces
		Sulphur	300-875mg
		Vanadium	150-300mcg
		Zinc	5-20mg
Folic acid	10-50mcg		
Follic acid	10-50mcg	Histidine	traces
Thiamine	0.1mg	Isoleucine	35-70mg
Riboflavin	0.5-1mg	Leucine	350-700mg
Pantothenic acid	0.14mg	Lysine	185-370mg
Pyridoxine	30mcg	Methionine	45-90mg
Cobalamin	0.4-8.0mcg	Phenylalanine	55-110mg
Ascorbic acid	50-200mg	Threonine	155-310mg
Cholecalciferol	1.0mcg	Tryptophan	traces
Tocopherol	15-30mg	Valine	175-350mg
Biotin	10-50mcg	Alanine	305-610mg
Menadione	1000mcg	Arginine	745-1490mg
		Aspartic acid	325-650mg
Aluminium	traces	Cysteine	60-120mg
Antimony	traces	Glutamic acid	345-690mg
Boron	2-10mg	Glycine	260-520mg
Calcium	120-750mg	Proline	200-400mg
Chloride	360-1000mg	Serine	150-300mg
Cobalt	0.1-1.0mg	Tyrosine	70-140mg
Copper	0.1-1.0mg		
Fluorine	10-30mg		

required for these beta-linked polymers are not found in humans. Thus, the carbohydrates are relatively unchanged through the digestive process. Because they are 'filling', seaweeds are a useful food for weight

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control. Their soft cell walls regulate bowel action without damaging the intestinal mucosa.

The amino acid profile of seaweed is similar to that of egg whites and legumes, although the trypsin inhibitor (a pancreatic protease) present in the brown algae reduces bioavailability. Experiments *in*

*vitro* show an 80 per cent digestibility overall. Several well documented research programmes worldwide, including recent work by Professor Anders Gustavsson at Lund University in Sweden, have confirmed the beneficial effect of Omega-3 fatty acids produced by plankton, algae and other water-grown organisms, on blood pressure and cholesterol levels.

*Ascophyllum* provides a well balanced supply of iron, important in the treatment of low blood pressure and is relatively rich in magnesium, a lack of which has proved causal in heart and circulation diseases. After potassium, magnesium is the most important anion. Magnesium is an important co-enzyme in more than 300 enzymatic reactions throughout the many human metabolic systems.

Vitamin B12, an essential nutrient for brain chemistry and healthy red blood cell production, is found in seaweed but not in terrestrial plants. Iodine, found in abundance in seafoods, is a key nutrient in the



production of the thyroid hormones thyroxine (T4) and triiodothyronine (T3). Thyroid hormones also require the amino acid tyrosine for their production, also present in *Ascophyllum*. Some of the key functions of the thyroid gland include:

- regulation of metabolic rate
- regulation of normal growth pattern including bone formation
- development of the nervous system
- regulating cardiac output ensuring sufficient oxygen supply
- essential for thermogenesis

Hypothyroidism (underactive thyroid) is commonplace in certain areas of the world which have low iodine food sources. More than 200mn people around the world are said to suffer from goitre. Goitre is an enlargement of the thyroid in response to low iodine status. The use of seaweed could help to prevent this chronic disease.

The brown colour of *Ascophyllum* results from the dominance of the xanthophyll pigment fucoxanthin; this masks the other pigments, chlorophyll, beta carotene and other xanthophylls. Key constituents of the plant include:

- fucoxanthin – carotenoid
- chlorophyll – green plant pigment (magnesium rich)
- beta-carotene – carotenoid
- laminaran – complex polysaccharide
- cellulose – complex polysaccharide (plant cell wall structure)
- alginic acid – complex polysaccharide
- fucoidin – a sulphated polysaccharide

Alginic acid, which passes through the body undigested, attracts and binds heavy metals such as arsenic, cadmium, lead, poisons contained in amalgam fillings, and radioactive substances such as Strontium 90, then expels them from the body through normal bowel action. Many Western health concerns can be attributed to high levels of toxins from our food and the environment. Alginic acid's ability to bind with and eliminate heavy metals and other poisons could be used as part of a nutritious, varied approach to combating such health concerns. Alginic acid is already an important ingredient in a leading de-tox product formulated by the President of the British Society for Mercury Free Dentistry and Clinical Nutrition.

Researchers at the Institute of Cancer Research, University of Trondheim in Norway, in co-operation with others at the University of California, have discovered

that alginates are co-polymers of mannuronic and guluronic acids which appear to stimulate the body's immune system. Several research programmes are examining the potentially anti-inflammatory substances in seaweed.

The high mannuronic acid content in *Ascophyllum* can work against certain bacterial infections by aiding the production of a special type of white blood cell known as the monocyte. Fucoidin, a polysaccharide fraction, has been shown to be effective in slowing or stopping growth of tumour cells in animals and has also been found to inhibit chemical carcinogenesis in rats. Fucoidin appears to be the main active anti-cancer component in brown algae.

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carotenoids present in seaweed along with the wide range of nutrients and complex polysaccharides are likely to have a combined effect on maintaining healthy cellular function. Oncological interest in seaweed is not new. The use of an algal phycolloid (Algasol T331) proved efficacious in the treatment of cancer patients, producing a good recovery in 68 per cent of 162 patients.

The immune system is dependent on nutrients including zinc, copper, manganese, selenium and iron for antioxidant enzyme activation. Essential fatty acids and amino acids also play a key role in enhancing immunity, thus seaweed can play a supporting role due to its diverse range of macro and micro nutrients. Research at the Norwegian University of Technology has

shown the immune enhancing properties of *Ascophyllum*.

Seaweeds are known to aid the healthy growth of nails, hair, bones, and teeth; ensure proper metabolism; to reduce blood cholesterol; to stimulate the reproductive organs; to act as antiseptics; to help digestion; and to keep the endocrine glands, especially the thyroid, functioning well. Due to the alkalinity of seaweed, it can help to balance out the typically hyper-acidic Western diet.

### Culinary uses

Seaweed can be used to naturally enhance the flavour and nutritional value of meals. It can be added to baked goods such as breads, biscuits and cakes, to improve flavour and texture; or it can be milled like salt and pepper in a regular grinder – in fact, salt can be omitted from recipes when seaweed is used. *Ascophyllum*'s sodium chloride content is typically less than two per cent. Seaweed is ideal as a condiment for seafood dishes; its subtle flavour can be used in sauces; it can be sprinkled on salads, pizzas, cereals or casseroles; or it can be blended with fresh vegetable juice.

The dosage used should be around 500mg daily for general health maintenance. Maximum benefit from using *A. Nodosum* is obtained through consistent and regular consumption. Seaweed is a wild harvested organic food with a proven safety record, but pregnant women and those with thyroid problems should consult a doctor.

### Conclusion

The use of wild organic foods such as seaweed in human nutrition has clear benefits, particularly as our soils become increasingly depleted in essential nutrients and our food supply more processed and genetically altered. The harvesting of seaweed provides an environmentally sound option for improving human and animal nutrition and the future potential for reducing chronic health conditions in 'goitre belts'.

*References are available on request.*

**Alex Kirchin** is a Nutrition Consultant. He graduated from the Institute of Optimum Nutrition and has worked for wild seaweed suppliers Seagreens.  
**Tel: +44 171 723 5567**  
**Fax: +44 171 723 5106**